REMARKS

I. Introduction

In response to the Office Action dated February 19, 2005, no claims have been amended or canceled, and no new claims are added. Please consider the following remarks.

II. The Cited References and the Subject Invention

A. The Castiel Reference

The Castiel reference discloses an elliptical satellite communication system including a constellation of satellites which orbit the earth at a height less than that necessary for geosynchronous orbits but which simulate the characteristics of geosynchronous orbits. The satellites' velocity near the apogee portion of their orbit approximates the rotational velocity of the earth, and during that period appear to hover over the earth. The ground stations on the earth always communicate with a satellite at or near its apogee, and hence that satellite appears to the ground station to hover over the earth. During the times when the satellite is outside the apogee portion, its communication is shut off to prevent any possibility of interfering with geosynchronous satellites and its power supply is used to charge a battery on the satellite. Thus, the power supply of the system can be reduced by an amount equivalent to the percentage of time the satellite is not used.

B. The Briskman Reference

The Briskman reference discloses satellite audio broadcasting systems including orbital constellations for providing high elevation angle coverage of audio broadcast signals from the constellation's satellites to fixed and mobile receivers within service areas located at geographical latitudes well removed from the equator.

C. The Anderson Reference

The Anderson reference discloses an apparatus for simultaneously receiving a first signal from a non-terrestrial source and a second signal from a terrestrial source on the same or overlapping channels using a receive antenna with posteriorly-directed sidelobes. The apparatus comprises at least one terrestrial transmitter transmitting information on at least one frequency

simultaneously usable by at least one satellite transmitting to a satellite receive antenna having a sensitivity characterizable by a primary sensitive axis directed substantially at satellite. The terrestrial transmitter includes a azimuthal gain characteristic directed substantially away from the Earth's Equator. In an alternative embodiment, the terrestrial transmitter is disposed at a location defining a vector angularly displaced from the primary sensitive axis by an angle of less than 90 degrees. A method of transmitting information is also disclosed. In this method the information is transmitted on at least one frequency simultaneously usable by at least one satellite transmitting to a satellite receive antenna having a sensitivity characterizable by a primary sensitive axis directed substantially at the satellite and a posterior secondary sensitive axis. The method is performed by transmitting the information from a terrestrially-based transmitter to a terrestrial receive antenna in a direction substantially away from the Equator.

D. The Subject Invention

Briefly, Appellant's invention, as substantially recited in independent claims 1, 16, and 24, is described as a system that provides at least near continuous broadcast service to a terrestrial receiver, thus augmenting a legacy satellite constellation in a geostationary orbit. In one embodiment, the system comprises a plurality of satellites (202A-202C) in an inclined, elliptical, geosynchronous orbit. The plurality of satellites (202A,-202C) arguments at least one legacy satellite (204) in a geostationary orbit. These features are illustrated in FIG. 2 and described in the specification as follows:

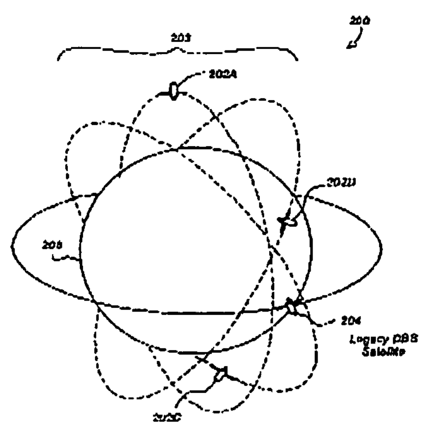


FIG. 2 is a diagram showing one embodiment of a satellite constellation of an enhanced video distribution system 200 using the principles of the present invention. The enhanced video distribution system comprises one or more legacy satellites 108 in a geostationary orbit around the Earth 206, and an augmenting satellite constellation 203 of three or more satellites 202A-202C (hereinafter alternatively referred to as satellite(s) 202) which are in inclined, substantially elliptical, geo-synchronous orbits with objective service at or near the center of CONUS.

In an embodiment substantially recited in independent claims 7, 22, and 31, the satellites 202A-202C provide a portion of the time of the at least near continuous broadcast service to the terrestrial receiver, and the inclined, elliptical, geosynchronous orbit is characterized by an orbital inclination of about 50 degrees and an orbital inclination of about 0.13.

In another embodiment substantially recited in independent claim 12, the system is described by a receiver station (132) for receiving at least near continuous broadcast service from a plurality of satellites (202A-202C). The receiver station (132) (illustrated in FIG. 1) includes an antenna 112 having a sensitivity characteristic (illustrated in FIG. 4) substantially corresponding to the apparent position of each of the satellites (202A-202C), as shown in FIG. 4 and in the discussion appurtenant thereto (page 7, line 13, et seq.).

In another embodiment substantially recited in independent claim 45, the satellite system is described by at least one satellite in a geostationary orbit (204, and illustrated in FIG. 2), a plurality of satellites, each in an inclined, elliptical geosynchronous orbit (202A-202C), also illustrated in FIG. 2), a receiver station antenna 112 that can communicate with said at least one satellite (204) and at least one of said plurality of satellites (202A-202C) during an active period without tracking, and a gateway (104) having a tracking antenna (106) to track said plurality of satellites (202A-202C). This embodiment is described in FIGs. 1, 2, 4, and 6 and the discussion appurtenant thereto.

Finally, in another embodiment substantially recited in independent claim 50, the satellite system is described by at least one satellite (204) in a geostationary orbit, an augmenting constellation (203) of satellites (202A-202C) in non-geostationary orbit, and a receiver station (132) having a relatively high gain, fixed antenna (112) capable of communication with said at least one satellite (204) in a geostationary orbit and an active one of said augmenting constellation of satellites (203). In this embodiment, a track of an apparent position of each satellite of the augmenting constellation of satellites relative to said antenna when said satellite is in an active period is substantially closed loop.

III. Argument

A. The Anderson Reference is Subject to 35 U.S.C. § 103(c)

The Office Action rejects claims 9-11 and 50-52 as unpatentable under 35 U.S.C. § 103(a) over Castiel in view of U.S. Patent 6,778,810, issued to Anderson. In response, please consider the following statement:

The subject Application (Serial No. 09/702,218) and U.S. Patent 6,778,810 were, at the time the invention of Application Serial No. 09/702,218 was made, owned by or subject to an obligation of assignment to the Hughes Electronics Corporation.

B. Independent Claims 1, 7, 9, 16, 22, 24, 31, 45, and 50 are Patentable Over the Cited Reference(s)

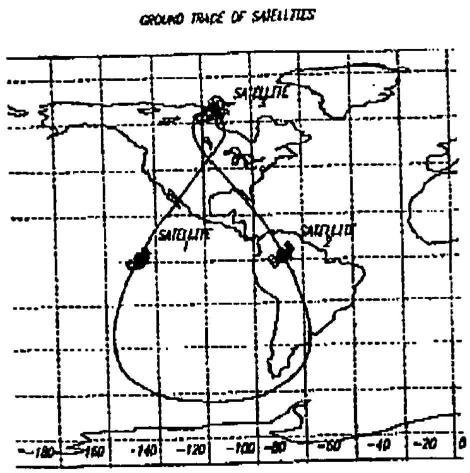
With Respect to Claims 1, 16, and 24: Claim 1 recites:

> *A system for providing at least near continuous broadcast service to a terrestrial receiver, comprising:*
> *a plurality of satellites, each satellite in an inclined, elliptical, geosynchronous orbit, each satellite providing a portion of time of the at least near continuous broadcast service to the terrestrial receiver,*
> *wherein the plurality of satellites augments at least one legacy satellite in a geostationary orbit.*

The Office Action acknowledges that the Castiel reference does not disclose "the plurality of satellites augments at least one legacy satellite in a geostationary orbit" but asserts that the Briskman reference teaches this limitation in the text below and in FIGs. 7 and 15 (reproduced below).

> Also, the choice of the apogee and perigee of the orbit considers the avoidance of passage through the Van Allen belts so radiation damage to the satellites is minimized and avoids too high apogees so excess space loss or antenna beam forming is minimized as discussed subsequently.
>
> Continuous coverage of a reasonably sized service area well removed from the equator cannot be achieved with a single satellite so analysis is generally performed on constellations with 2, 3 and 4 satellites. The analyses are performed using known computer programs. The amount of elevation angle coverage improvement diminishes for constellations with more than three satellites. Constellations with more than 4 satellites are technically feasible and only marginally improve both elevation angle coverage and redundancy. FIG. 8 shows the elevation angle coverage of a two satellite constellation as seen from New York City. No appreciable satellite spatial diversity is possible making multipath mitigation from this technique unavailable. (col. 4, line 61 - col. 5, line 10)

FIG. 15



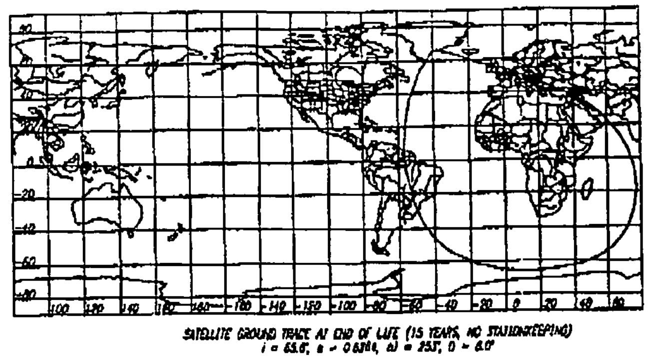


FIG. 7

The Office Action argues that the foregoing discloses a "legacy satellite (old or used satellite) in a geostationary orbit" because it teaches "one of the geosynchronous orbits (could be legacy or existing or old satellite) that has been used and currently working in the sky).

The Applicant does not understand how the foregoing teaches a system wherein "the plurality of satellites augments at least one legacy satellite in a geostationary orbit". In the Applicant's opinion, the foregoing fails to disclose even a satellite in a geostationary orbit, let alone a plurality of satellites that augment at least one legacy satellite in a geostationary orbit.

It is axiomatic that patent claims cannot stand rejected using hindsight reconstruction to arrive at the Applicant's invention. The Applicant respectfully suggests that this is exactly what the Office Action has done. The foregoing passage does not disclose nor teach a system wherein "the plurality of satellites augments at least one legacy satellite in a geostationary orbit", and for this reason, claim 1 is allowable over the art of record.

Since the Castiel and Briskman references, even when combined, do not teach the Applicant's claims, the rejection of claim 1 should be reversed.

The Office Action has also changed it's proffered motivation for modifying the Castiel reference as it alleges Briskman teaches one of ordinary skill in the art to do. The originally proffered motivation was "to achieve optimum using satellite and reducing cost in satellite system."

The currently proffered motivation is "to improve the continuous broadcasting service to customers and to achieve optimizing coverage of particular service area in direct broadcast satellite system."

The Applicant's response to the currently proffered motivation is the same as their response to the earlier-proffered motivation: Castiel itself recites the disadvantages in geosynchronous systems. As described below:

> The inventors of the present invention have noted a number of drawbacks associated with geosynchronous ("geo") satellite systems. One major drawback is the cost to raise a satellite into a geo orbit. Geosynchronous orbit occurs at around 36,000 kilometers. The cost to boost the satellite into orbit is directly proportional to the height of the orbit. Therefore, it is expensive to boost a satellite into geosynchronous orbit. This cost must be amortized over the lifetime of the satellite, making geo satellites very expensive.
>
> Another problem results from the geometry of coverage of a geosynchronous satellite system. A three satellite geostationary satellite system could have the satellites spaced equally along the equator, at 120.degree. intervals. Their limit of visibility on the equator is calculated from the relationship:
>
> $$2\{\cos^{-1}(R_E/a_{geo})\}=2\{\cos^{-1}(6378/35786)=2\{79.73deg\}=159.47deg$$
>
> where 6378 is the radius of the earth in kilometers, and 35786 is the radius out to the geostationary ring. Taking difference between the above value and 120 degrees, it is clear that there is approximately 40 degrees of overlapping coverage by two adjacent geo satellites for an observer on the equator. There will be even less at greater latitudes. Many global services, however, require world-wide transmission of their information to the whole world. Since each of the satellites only covers one part of the world, some other way must be used to disseminate the information from the source to the satellites covering the rest of the world.
>
> The information begins its transmission at a link. That link transmits up to the satellite in orbit, which then retransmits the information to communicate to, or "cover" one portion of the earth. The same information must also be transmitted to another of the satellites to cover another part of the earth. The information is either sent: 1) over a land line between the link on the earth and ground stations that service areas for the other satellite(s), or 2) via satellite-to-satellite transmission. The land link requires additional equipment and expense. The satellite link also requires additional equipment, but in addition operates a transmission across the two ends of the 42,000 kilometer equilateral triangle. This requires a transmission which is some 70,000 kilometers long. This system requires a second antenna on each of the satellites in addition to complicating control and pointing structure. Even then, the long communication channel may cause noise in the channel.
>
> One of the most difficult-to-solve problem results from the geometry of the geosynchronous orbit. There is only one available orbital position ("band") for geosynchronous satellites. This band is already saturated with satellites. Satellites occupy the geo band with only 2 degrees of spacing therebetween. These are referred to as orbital "slots". Most of the slots are now occupied, making it difficult to find positions for any more geostationary satellites. However, other satellite locations cannot be allowed to interfere with the communication to the geo satellites when operating at the same frequencies.
>
> The system of the present invention obtains the advantages of geosynchronous satellites without using the high altitude circular orbit normally used for geo satellites. The present invention uses a plurality of satellites in orbits chosen such that each desired point of coverage on the earth communicates with a different satellite at different times, and in a direction of antenna pointing separated angularly from any geo satellite(s), such that there is no radio frequency interference, even when operating at the same frequency as a geo satellite. Thus, the present invention alleviates the present "geo-slot" problem. The lower altitudes of the present invention also lead to smaller link distances from ground-to-satellite and from satellite-to-satellite, decreasing the power

> required due to path loss. These lower altitudes also decrease the time delay which can be annoying in voice transmissions. Thus, the present invention provides a unique solution to some of the problems of using geo satellites. (col. 1, line 42 - col. 2, line 30).

As is apparent from a review of the passages reproduced above, the Castiel reference teaches an alternative to a geostationary legacy constellation, not one that augments such a constellation.

Indeed, the Castiel reference teaches that interaction between legacy geostationary constellations is regarded as undesirable "interference," and thus, expressly teaches away from the combination suggested by the Final Office Action.

Claims 16 and 24 recite features analogous to those of claim 1 and is patentable for the same reasons.

<u>With Respect to Independent Claims 7, 22, and 31</u>: Claim 7 recites:

> *A system for providing at least near continuous broadcast service to a terrestrial receiver, comprising:*
> *a plurality of satellites, each satellite in an inclined, elliptical, geosynchronous orbit, each satellite providing a portion of time of the at least near continuous broadcast service to the terrestrial receiver, wherein the orbit is characterized by an orbital inclination approximately equal to 50 degrees and an eccentricity approximately equal to 0.13.*

The Office Action argues that this feature is disclosed in the Briskman reference as follows:

> Inclination. The inclination of the satellites is generally chosen between about 40.degree. and about 80.degree. so they cover the desired high latitude service areas during their transit overhead.
>
> Eccentricity. The eccentricity is chosen to have a high apogee over the service area so the satellites spend the maximum amount of time overhead. Practically, the eccentricity is limited by the increased distance that the higher is from the service area since this extra distance must be overcome either by higher satellite transmission power, a more directive satellite antenna during this portion of the orbit or combinations thereof. The eccentricity range in preferred embodiments is from about 0.15 to about 0.30. Eccentricities between about 0.15 and about 0.28 are highly preferred since they avoid most of the Van Allen belts. (col. 1, line 65 - col. 2, line 19)

The foregoing teaches orbital inclinations of between about 40 to 80 degrees and eccentricities from about 0.15 to 0.30. Claim 7 recites an orbital eccentricity *below* the value taught by Briskman.

The Applicant also disagrees that the prior art suggests that the Castiel reference be modified as described in Briskman. The Final Office Action itself pointed out that Castiel teaches a system deployed at a "critical inclination" of 63.435 degrees for posigrade orbits or 116.565 for retrograde orbits, in order to provide a stable elliptical orbit with an apogee in the required place.

> The "inclination" I is the angle between the orbital plane of the satellite and the equatorial plane. Prograde orbit satellites orbit in the same orbital sense (clockwise or counter-clockwise) as the earth. For prograde orbits, inclination lies between 0.degree. and 90.degree.. Satellites in retrograde orbits rotate in the opposite orbital sense relative to the earth, so for retrograde orbits the inclination lies between 90 degrees and 180 degrees.
>
> The "critical inclination" for an elliptical orbit is the planar inclination that results in zero apsidal rotation rate. This results in a stable elliptical orbit whose apogee always stays at the same latitude in the same hemisphere. Two inclination values satisfy this condition: 63.435.degree. for prograde orbits or its supplement 116.565 degrees for retrograde orbits. (col. 6, lines 24-36)

The Office Action now argues that one of ordinary skill in the art would be motivated to modify this design to "improve the satellite pattern for continuous broadcasting service and optimizing coverage of particular service area in direct broadcast satellite system." The Applicant respectfully disagrees. Plainly, Castiel itself teaches that such a modification should *not* be made, but that instead the inclination be chosen to keep a stable elliptical orbit with an apogee always at the same latitude in the same hemisphere. Finally, one question left unanswered by the Office Action is how changing Castiel's inclination would "improve the satellite pattern for continuous broadcasting service and optimizing coverage of particular service area." It is not apparent to the Applicant how or if this would be the case.

The Applicant's selection of an inclination and an eccentricity approximately equal to 50 and 0.13 provides CONUS coverage for an 8 hour period, and eliminates sudden shifts in the apparent position of the active satellite, as described below:

> FIG. 3 is a diagram illustrating the ground track 302 of the orbit of the satellite 202 specified in Table I, centered at the geographical center of CONUS for an 8-hour period when the satellite is providing broadcast services to a subscriber. The outside rings 304 show 57 degree elevation contours at 10 minute intervals within the active period. Note that all of CONUS (all 48 states) are covered within the 57 degree elevation angle. The ground track 302 of the orbit of the satellite 202 is a closed loop in a (reversed) teardrop shape. This eliminates sudden shifts in the apparent position of the active satellite (as the task of transmitting the broadcast signal is shifted from a first satellite (e.g. 202A) to a second satellite (e.g. 202B) in the constellation) and thus allows an IRD 132 with a fixed (non tracking) receiver station antenna 112 to receive uninterrupted service from the satellite constellation.

Claims 22 and 31 recite features analogous to those of claim 7, and are patentable on the same basis.

<u>With Respect to Claim 9</u>: Claim 9 recites:

A receiver station for receiving at least near continuous broadcast service from a plurality of satellites in an inclined, elliptical, geosynchronous orbit, comprising:

an antenna having a sensitivity characteristic substantially corresponding to the track of the apparent position of each of the satellites.

Claim 9 stands rejected as unpatentable over Castiel in view of Anderson. Since Anderson does not qualify as prior art under 35 U.S.C. § 103(c) (see statement above in section IV.A.), this rejection should be withdrawn.

The Castiel reference itself is of no help, because it teaches a *tracking* antenna (e.g. one that tracks the satellites as they move in apparent position). This teaches away from an antenna having a sensitivity characteristic that does not require satellite tracking (e.g. one with a sensitivity characteristic corresponding to the apparent position of each of the satellites):

> The satellites follow repeating ground tracks, since the cycle of satellite movement shown in FIGS. 4A-4F continually repeats. **Importantly, this allows the ground tracking antenna 212 to continually follow the same path, starting at a beginning point, tracking the satellite, and ending at the coalesce point.** After the satellites coalesce as shown in FIG. 4A, the antenna begins its tracking cycle.
>
> The inventors of the present invention have optimized this system for preventing interference with geo satellites.
>
> Specifically, consider FIG. 4G which shows a multiplicity of satellites in inclined elliptical orbits. The present invention preferably operates to monitor satellites at and near their apogee positions. The satellites near perigee are moving too rapidly, and hence are not tracked. More generally, the system of the present invention operates such that the satellites are only being used at certain times during their orbits. In this preferred embodiment, those certain times are when the satellites are at apogee. Non geosynchronous circular arrays are commonly used at present; they are actually much less efficient, since with zero eccentricity they spend a significantly greater time on the side of the earth away from the populated continents. The arrays of the present invention, on the other hand, spend most of the time at or near apogee over the populated continents of interest, and a relatively small time (at high angular velocities) passing through perigee in regions of no commercial interest. (col. 11, line 63 - col. 12, line 22, emphasis added)

<u>With Respect to Claim 45</u>: Claim 45 recites:

A satellite system comprising:
at least one satellite in a geostationary orbit;
a plurality of satellites, each in an inclined, elliptical geosynchronous orbit;
a receiver station antenna that can communicate with said at least one satellite and at least one of said plurality of satellites during an active period without tracking, and
a gateway having a tracking antenna to track said plurality of satellites.

According to the Final Office Action, the foregoing is taught by Castiel in view of Briskman under the same rationale as claim 1. The Final Office Action further indicates that Castiel further discloses a receiver station that can communicate with at least one satellite and at least one of said

plurality of satellites during an active period without tracking as described below:

> The video input to be distributed is received as video input 200, and input to a video coder 202 which produces digital coded video information. This digital coded video is multiplexed with a number of other channels of video information by video multiplexer 204. The resultant multiplexed video 206 is modulated and appropriately coded by element 208 and then up-converted by transmitter element 210. The up-converted signal is transmitted in the Ku band, at around 14 GHz, by antenna 212. Antenna 212 is pointed at the satellite 100 and received by the satellite's receive phased array antenna 214. Antenna 212 is controlled by pointing servos 213.
>
> The received signal is detected by receiver 216, from which it is input to multiplexer 218. Multiplexer 218 also receives information from the inter-satellite transponders 240.
>
> The output of multiplexer 218 feeds the direct transponders 250, which through a power amplifier 252 and multiplexer 254 feeds beam former 256. Beam former 256 drives a transmit, steerable phased-array antenna 260 which transmits a signal in a current geo frequency band to antenna 262 in the remote user terminal 106. This signal preferably uses the same frequency that is used by current geo satellites. The phased array antenna is steered by an on-board computer which follows a pre-set and repeating path, or from the ground. This information is received by receiver 264, demodulated at 266, and decoded at 268 to produce the video output 270. (col. 9, lines 1-27)

and in the FIGs. 1 and 2, reproduced below:

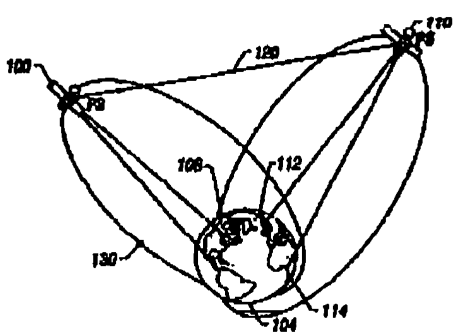


FIG. 1

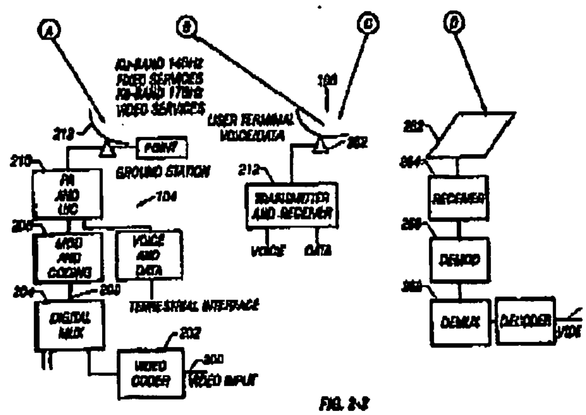


FIG. 2

The Applicant respectfully disagrees. Nothing in the foregoing teaches a receiver station that can communicate with said at least one satellite and at least one of a plurality of satellites during an active period without tracking. As described above with regard to the Applicant's independent claims, Castiel teaches the use of a tracking antenna at the receiver station. The Applicant believes that the majority of the text relied upon by the Final Office Action refers to the transmitting satellite,

and what little refers to the receiver station does not describe the features recited in claim 45. Accordingly, the Applicant respectfully traverses this rejection.

With Respect to Claim 50: Claim 50 recites:

> *A satellite system, comprising:*
> *at least one satellite in a geostationary orbit;*
> *an augmenting constellation of satellites in non-geostationary orbit, and*
> *a receiver station having a relatively high gain, fixed antenna capable of communication with said at least one satellite in a geostationary orbit and an active one of said augmenting constellation of satellites,*
> *wherein a track of an apparent position of each satellite of the augmenting constellation of satellites relative to said antenna when said satellite is in an active period is substantially closed loop.*

While the Office Action acknowledges that Castiel does not disclose "a receiver station having a relatively high gain, fixed antenna capable of communication with at least one satellite in geostationary orbit and an active one of said augmenting constellation of satellites", the Office Action argues that Anderson teaches "the receiver station having a highly [sic] gain and fixed antenna communicating with a geostationary satellite and other satellites."

By virtue of the statement made above in section IV.A., the Anderson reference is not a reference under 35 U.S.C. § 103(b), and this rejection should be withdrawn.

C. Dependent Claims 2-6, 10-11, 15, 17-21, 25-30, 46-49, and 51-52 are Patentable Over the References of Record

Claims 2-6, 10-11, 15, 17-21, 25-30, 46-49, and 51-52 each include the limitations of the claims they depend upon and are patentable on the same basis. In addition, claims 2-6, 10-11, 15, 17-21, 25-30, 46-49, and 51-52 recite features rendering them even more remote from the cited references.

Particularly, the Final Office Action rejects claims 10-11 as unpatentable over Castiel in view of Briskman and further in view of Anderson. The Applicant respectfully traverses this rejection. Claim 10 recites:

> *The receiver station of Claim 9, wherein the receiver antenna comprises a reflector having a focal line and a focal point on the focal line and a bead, wherein the bead is disposed offset from the focal point.*

The Office Action indicates these features are disclosed in the Anderson reference, and that one of ordinary skill in the art at the time the invention was made to modify the Castiel system as taught by Anderson to "enhance the broadcast signal adaptability".

By virtue of the statement made above in section IV.A., the Anderson reference is not a reference under 35 U.S.C. § 103(b), and this rejection should be withdrawn.

IV. Conclusion

In view of the above, it is submitted that this application is now in good order for allowance and such allowance is respectfully solicited. Should the Examiner believe minor matters still remain that can be resolved in a telephone interview, the Examiner is urged to call Applicant's undersigned attorney.

Respectfully submitted,

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